

# **Community Health Air Pollution Information System (CHAPIS): Web-Based Mapping Tool**



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Cal/EPA  
June 2003

# **CHAPIS: Community Health Air Pollution Information System**

-- Web-Mapping Tool - Prototype June 2003 --

- ◆ **Provide Interactive Maps of Air Pollution Emission Sources**
- ◆ **Include Stationary, Mobile, & Areawide Emissions**
- ◆ **Provide Maps or Tabular Information**
- ◆ **Collaboration with CAPCOA and Districts**

*NOTE: Data in Prototype are Not Real Data*





# Populating Facility Data in Stages for Quality

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- ◆ **Initial pollutants and facilities**
  - Criteria Pollutants for 10 ton/year facilities
  - Toxics for Refineries, Power Plants
  - HRA facilities - Metal fabrication, Chemical, Aerospace
- ◆ **On-going future additions**
  - Coordination with CAPCOA
  - Other HRA, Gas stations, Platers, Dry Cleaners
- ◆ **Initial public data release ~summer 2003**

Welcome to

California



HOLLYWOOD



California

Air Resources Board

CHAPIS

Community Health Air Pollution Information System



## More about CHAPIS

Last Updated December 19, 2002

### What are the Sources and Types of Air Pollution?

Cars and trucks ([on-road mobile](#)) are the largest sources of air pollution in California. Other sources of air pollution include trains, planes, and lawn and garden equipment ([other mobile sources](#)), refineries and power plants ([stationary sources or facilities](#)), as well as a miscellaneous category of emission sources that include consumer products like hairspray, and solvent use, such as painting ([area-wide](#)). Air pollution includes traditional smog-forming pollutants ([criteria pollutants](#)), as well as [toxic air pollutants](#). The ARB receives information on criteria pollutants every year as part of the [emission inventory](#), and information on toxic pollutants every four years as part of the air toxics "[Hot Spots](#)" program. One of the reasons to develop CHAPIS was the need to have more up-to-date information on toxic air pollutants than is sometimes collected through the "Hot Spots" program. To learn more about where the information comes from, click [here](#).

### What does it all mean?

Emissions from mobile sources (on-road and off-road sources) dominate the regional health impacts of air pollution, and contribute the most to the total amount of air pollution. An individual facility's contributions are usually much lower than the pollution from mobile sources. The amount of emissions is only one component affecting health; it is the exposure to those emissions that determines health effects. Exposure is the amount of pollution that someone actually breathes, rather than the total that is released from any one source. Exposure is determined by how far away the source is, the person's activity, what the toxicity of the pollutant is, and how it is released into the air and dispersed by the wind. The Air Resources Board works together with the 35 local [air districts](#) to keep track of all the various sources of air pollution in California. This initial prototype of CHAPIS contains a subset of facilities that include larger and higher priority facilities. This is an ongoing process where we will periodically make improvements and additions to the data. For a status of what is included to date, click [here](#).

[BEGIN MAP SEARCH NOW](#)



Start by picking a region of interest:

[California Home](#)

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California

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Air Resources Board

CHAPIS

Community Health Air Pollution Information System



## Welcome to CHAPIS - The Community Health Air Pollution Information System

Last Updated Nov. 18, 2002

The California Air Resources Board (ARB) developed CHAPIS as an Internet-based tool to provide a graphical way to look at the amounts and spatial distribution of air pollution emission sources in California. CHAPIS provides a mapping tool to analyze the spatial characteristics of California's Air Pollutant [Emission Inventory](#), for emissions of [traditional criteria air pollutants](#) and key [toxic air pollutants](#). This is a prototype, showing [selected data](#) from the ARB and [local Districts](#), for [point source](#), [mobile source](#), and [dispersed source](#) emissions data. For online help or more information about CHAPIS, click [here](#). To begin using CHAPIS, select an area of interest using the menus or map provided below.

### Select an Area of Interest:

Select an area of interest using the menus below or use the map, and click on the county of your choice.

County: Air Basin: Air District: Region: Or Enter a Zip Code: [Go To Zip](#)

Website developed by VESTRA Resources Inc.

[ARB Homepage](#)

H:\Data\_CHAPIS\_HA...

Microsoft PowerPoin...

CHAPIS Launch ...

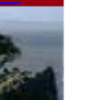
SnagIt

Internet



9:23 AM

California Home

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HOLLYWOOD



California

Air Resources Board

CHAPIS

Community Health Air Pollution Information System

**Welcome to CHAPIS - The Community Health Air Pollution Information System**

Last Updated Nov. 18, 2002

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County: Air Basin: Air District: Region: **Or Enter a Zip Code:** [Go To Zip](#)

\* This website is best viewed with your screen area set to 1024 x 768 px.



Map Loading..... Please Wait



Website developed by VESTRA Resources Inc.


VESTRA

[ARB Homepage](#)

A department of the California Environmental Protection Agency





## Main CHAPIS Map Window


**California** Air Resources Board

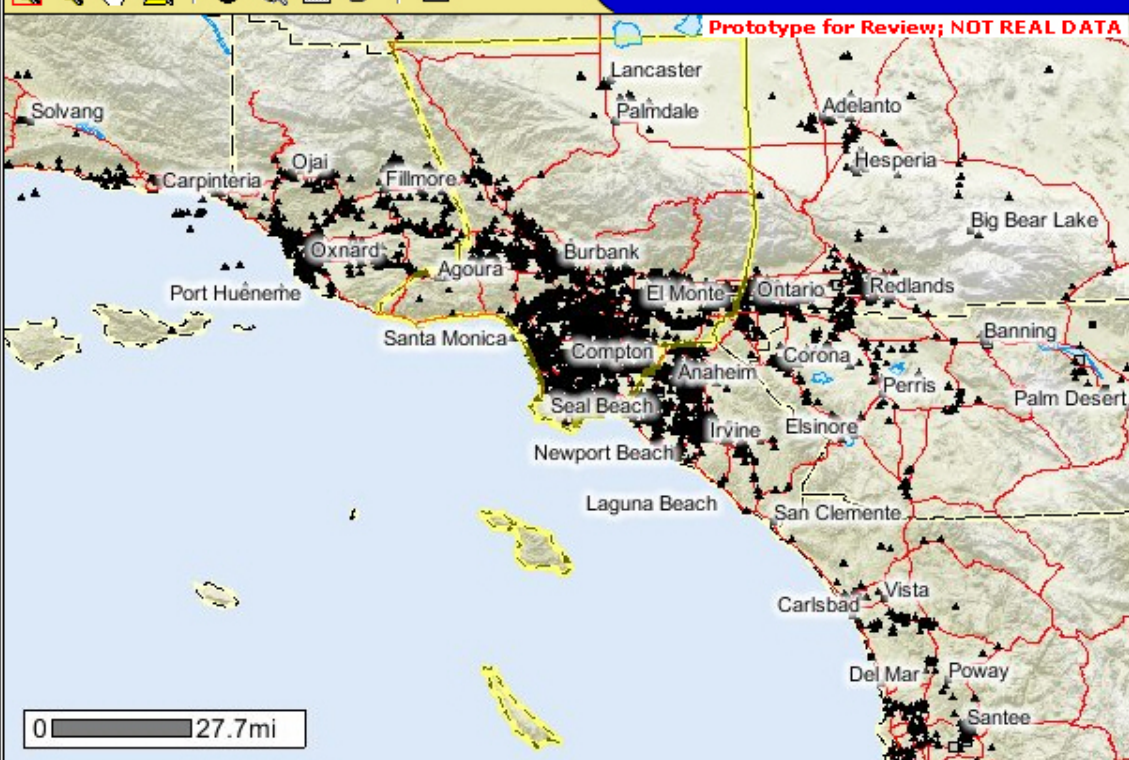
**CHAPIS** Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

**Navigation**  


**Analysis**  


**Overview Map**  




Prototype for Review; NOT REAL DATA

**Current Settings**  
Tool Mode: **Zoom In**  
County: Los Angeles

**Messages**

**Legend / Facilities**  
▲ Facilities

Show Full Legend  
Show Layer List

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.  
Gridded Emissions Gridded Risk

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View  
Calculate Stats

Print Map Get Help Start Page

Map Width: 221 miles

Select pollutant: **Toxic & Criteria Pollutants** Go  
Select facility type: **Facility Types & SIC Codes** Go

**Map Settings**  
Identify Layer: Emissions Map Tip Layer: Emissions Buffer Radius: 2 miles

**Jump to a new location**  
County/Air Basin/Air District: Los Angeles Regions: **REGIONS** Zip Code: Go To Zip

## Toggle Overview Map On/Off

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Toggle Overview Map On/Off

Navigation Analysis Overview Map

Prototype for Review; NOT REAL DATA

Map showing Los Angeles area with various cities labeled: Lancaster, Palmdale, Adelanto, Hesperia, Big Bear Lake, Ojai, Fillmore, Agoura, Burbank, El Monte, Ontario, Redlands, Banning, Santa Monica, Compton, Anaheim, Corona, Perris, Palm Desert, Seal Beach, Irvine, Elsinore, Newport Beach, Laguna Beach, San Clemente, Carlsbad, Vista, Del Mar, Poway, Santee.

0 27.7mi

Map Width: 221 miles

Current Settings  
Tool Mode: Zoom In  
County: Los Angeles

Messages

Legend / Facilities  
▲ Facilities  
Show Full Legend  
Show Layer List

Combined Sources  
Mobile, Areawide, and Stationary Totals.  
Gridded Emissions Gridded Risk

Analysis of Sources in Map View  
Calculate Stats for all Point Sources in the Map View  
Calculate Stats

Print Map Get Help Start Page

Select pollutant: —Toxic & Criteria Pollutants— Go Select facility type: —Facility Types & SIC Codes— Go

Map Settings  
Identify Layer: Emissions Map Tip Layer: Emissions Buffer Radius: 2 miles

Jump to a new location  
County/Air Basin/Air District: Los Angeles Regions: —REGIONS— Zip Code: Go To Zip



## Choose a pollutant and zoom in

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to Zoom In

**Navigation** **Analysis** **Overview Map**

1) Click to select this map-tool 2) Click or drag a box on map to ZOOM IN

Prototype for Review; NOT REAL DATA

**Current Settings**  
Tool Mode: Zoom In  
County: Los Angeles

**Messages**

**Legend / Facilities** **Show Full Legend**  
Facilities **Show Layer List**

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.  
**Gridded Emissions** **Gridded Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View  
**Calculate Stats**

**Print Map** **Get Help** **Start Page**

Map Width: 221

Select pollutant: **Toxic & Criteria Pollutants** **Go**

Select facility type: **Facility Types & SIC Codes** **Go**

**Map Settings**  
**Identify Layer:** Emissions **Map Tip Layer:** Emissions **Buffer Radius:** 2 miles

**Jump to a new location**  
**County/Air Basin/Air District:** Los Angeles **Regions:** REGIONS **Zip Code:** **Go To Zip**

**Map**

**Legend / Facilities**

- Toxic & Criteria Pollutants—
- Toxic Pollutants—
- All toxic compounds
- Potency-weighted lbs
- Acetaldehyde
- Acrolein
- Acrylonitrile
- Ammonia
- Arsenic (Inorganic) Compounds
- Asbestos and Related Fibers
- Benzene

**Map**

**Map Settings**

**Jump to a new location**

# Choose 'Gridded Emissions' to See Combined Sources

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

**Navigation** **Analysis** **Overview Map**

**Prototype for Review; NOT REAL DATA**

**Current Settings**  
Tool Mode: **Zoom In**  
County: Los Angeles

**Messages**

**Legend / Facilities**  
Benzene (Lbs./yr.)  
▲ 0 - 1000  
▲ 1000 - 25000  
▲ 25000 - 116920

**Show Full Legend**  
**Show Layer List**

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.  
**Gridded Emissions** **Gridded Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View  
**Calculate Stats**

**Print Map** **Get Help** **Start Page**

Map Width: 59 miles

Select pollutant: Benzene **Clear** Select facility type: —Facility Types & SIC Codes— **Go**

**Map Settings**  
Identify Layer: Emissions Map Tip Layer: Emissions Buffer Radius: 2 miles

**Jump to a new location**  
County/Air Basin/Air District: Los Angeles Regions: —REGIONS— Zip Code: **Go To Zip**

NOTE: Displayed data are not real data.



# Gridded Emissions: Combines Mobile, Areawide, & Point Emissions in Cell

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

Navigation Analysis Overview Map

Prototype for Review; NOT REAL DATA

Map showing Gridded Emissions for Benzene (Lbs./yr.) in Los Angeles County. The map displays a grid overlay with various colored cells representing different emission levels. Key locations labeled include Burbank, Pasadena, Monrovia, San Dimas, Ontario, Los Angeles, Santa Monica, Beverly Hills, Whittier, Hawthorne, Compton, Redondo Beach, Long Beach, Seal Beach, Anaheim, and Santa Ana.

Legend / Facilities

Benzene (Lbs./yr.)

- No Value
- 0.000203 - 113000
- 113000 - 226000
- 226000 - 339000

Toggle Legend

Current Settings

Tool Mode: **Zoom In**  
County: Los Angeles

Messages

Gridded Emissions Categories

|  |                                     |
|--|-------------------------------------|
| Onroad Mobile                                  | <input checked="" type="checkbox"/> |
| Offroad Mobile                                 | <input checked="" type="checkbox"/> |
| Industrial                                     | <input checked="" type="checkbox"/> |
| Small Commercial                               | <input checked="" type="checkbox"/> |
| Areawide (Dispersed solvents, Painting, Other) | <input checked="" type="checkbox"/> |

Select All Clear All

Combined Sources

Mobile, Areawide, and Stationary Totals.

**Gridded Emissions** Gridded Risk

Analysis of Sources in Map View

Calculate Stats for all Point Sources in the Map View

**Calculate Stats**

Print Map Get Help Start Page

Select pollutant: Benzene Clear Select facility type: Facility Types & SIC Codes Go

Map Settings

Identify Layer: Gridded Emissions Map Tip Layer: Emissions

Jump to a new location

County/Air Basin/Air District: Los Angeles Regions: REGIONS Zip Code: Go To Zip

Click to change the visibility of gridded emissions layers

Internet

Start CHAPIS - Microsoft Internet Explorer CHAPIS Gridded Emissions

9:45 AM

Not real data.



Click a Grid Cell For Numeric Contributions and Total

Click on the map to **Identify** a feature

Navigation Analysis Overview Map

CHAPIS: Identify Results - Microsoft Internet Explorer

File Edit View Favorites Tools Help

1 feature found

Benzene(Lbs./yr.) from selected source categories:

| Onroad Mobile | Offroad Mobile | Industrial | Small Commercial | Areawide (Dispersed solvents, Painting, Other) | Total |
|---------------|----------------|------------|------------------|--|-------|
| 24300         | 5900           | 810        | 430              | 640  | 32100 |

NOTE: Displayed data are not real.

Map Width: 59 miles

Select pollutant: Benzene Clear Select facility type: —Facility Types & SIC Codes— Go

Map Settings

Identify Layer: Gridded Emissions Map Tip Layer: Emissions Buffer Radius: 2 miles

Jump to a new location

County/Air Basin/Air District: Orange Regions: —REGIONS— Zip Code: Go To Zip



Turn off Gridded, Zoom in.

Scale-dependent Layers Appear and/or Change as Zoom In

Navigation Analysis Overview Map

San Fernando

Prototype for Review; NOT REAL DATA

Burbank

0 2.1mi

Map Width: 17 miles

Select pollutant: Benzene Clear Select facility type: —Facility Types & SIC Codes— Go

Map Settings

Identify Layer: Emissions Map Tip Layer: Emissions Buffer Radius: 2 miles

Jump to a new location

County/Air Basin/Air District: Los Angeles Regions: —REGIONS—

Tool Mode: Zoom In  
County: Los Angeles

Messages

Legend / Facilities Show Full Legend

Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

Combined Sources  
Mobile, Areawide, and Stationary

Gridded Emissions

Analysis of Sources in Map  
Calculate Stats for all Point Sources

Calculate Stats

Print Map Get

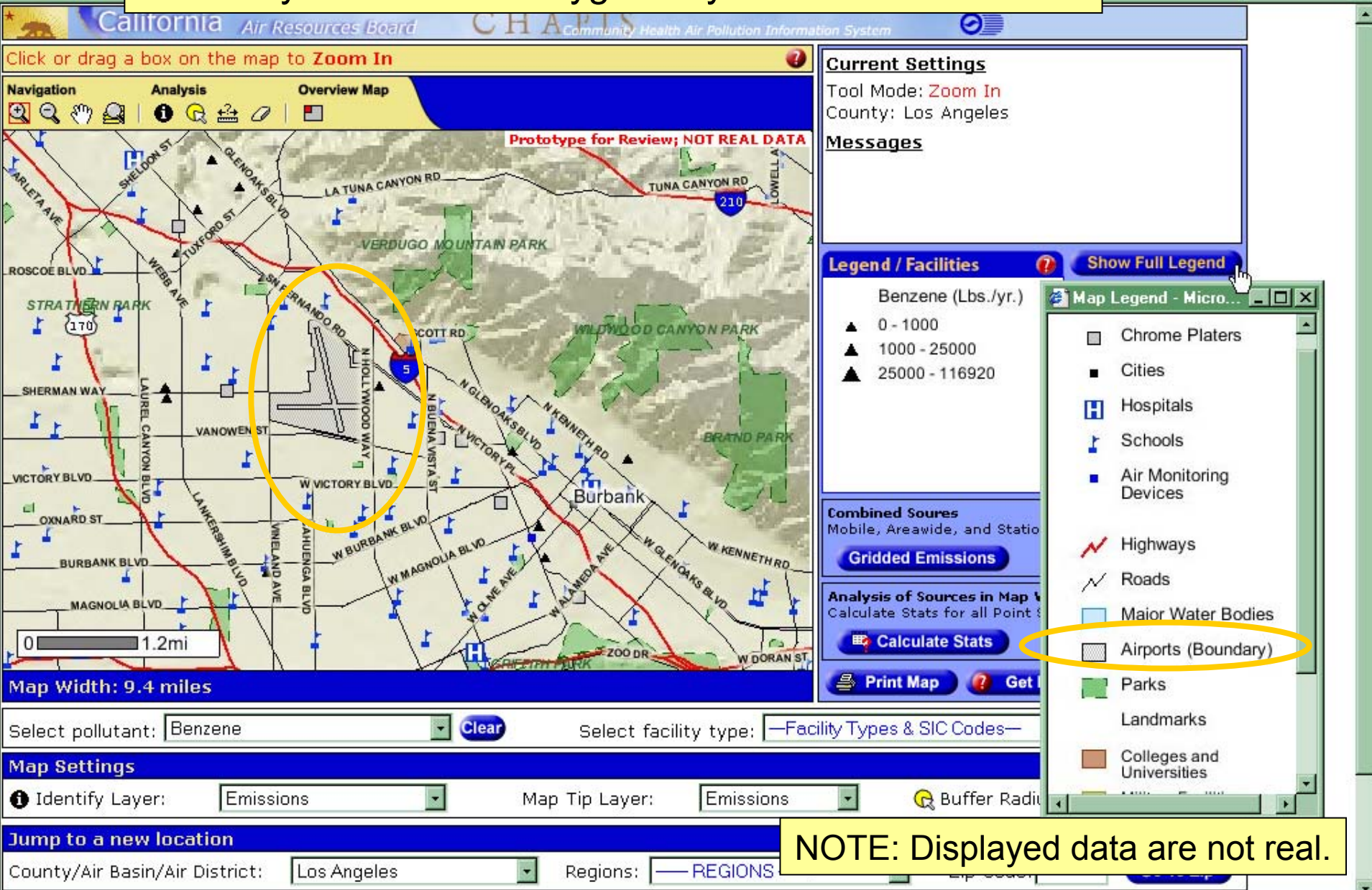
Map Legend - Micros...

- Chrome Platers
- Cities
- ✈ Airports (Point)
- Air Monitoring Devices
- ↗ Highways
- ↗ Roads
- Major Water Bodies
- Counties

NOTE: Displayed data are not real.



# Point Layer Becomes Polygon Layer When Zoomed In





## Sample Neighborhood Map with Point Sources, Roads, Schools, etc. (scale-dependent)

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

**Navigation** **Analysis** **Overview Map**

**Current Settings**  
Tool Mode: **Zoom In**  
County: Los Angeles

**Messages**

**Legend / Facilities** **Show Full Legend**

**Map Legend - Mi...**

- Chrome Platers
- Cities
- Hospitals
- Schools
- Air Monitoring Devices
- Highways
- Roads
- Major Water Bodies
- Airports (Boundary)
- Parks
- Landmarks
- Colleges and Universities

**Combined Sources**  
Mobile, Areawide, and State

**Gridded Emissions**

**Analysis of Sources in Map**  
Calculate Stats for all Point Sources

**Calculate Stats**

**Print Map** **Go**

**Map Width: 6.3 miles**

Select pollutant: **Benzene** **Clear** Select facility type: **—Facility Types & SIC Codes—**

**Map Settings**

**Identify Layer:** **Emissions** **Map Tip Layer:** **Emissions**

**Jump to a new location**

County/Air Basin/Air District: **Los Angeles** **Regions:** **—REGIONS—** Zip Code: **Go To Zip**

**Not Real Data**

Click to show the full legend

Internet

Start CHAPIS - Microsoft Internet Explorer Map Legend - Micros...

10:28 AM

# Hover label tool gives facility name immediately

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

**Navigation** **Analysis** **Overview Map**

**ABC COMPANY INC (3240788)**

**Prototype for Review NOT REAL DATA**

**Current Settings**  
Tool Mode: **Zoom In**  
County: Los Angeles

**Messages**

**Legend / Facilities** **Show Full Legend** **Show Layer List**

Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.

**Gridded Emissions** **Gridded Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View

**Calculate Stats**

**Print Map** **Get Help** **Start Page**

Map Width: 6.3 miles

Select pollutant: Benzene **Clear** Select facility type: —Facility Types & SIC Codes— **Go**

**Map Settings**

**Identify Layer:** Emissions **Map Tip Layer:** Emissions **2 miles**

**Jump to a new location**

County/Air Basin/Air District: Los Angeles **Regions:** —REGIONS— **Zip Code:** **Go To Zip**

**Not Real Data**



Click or drag a box on the map to **Zoom In**

## Navigation



## Analysis

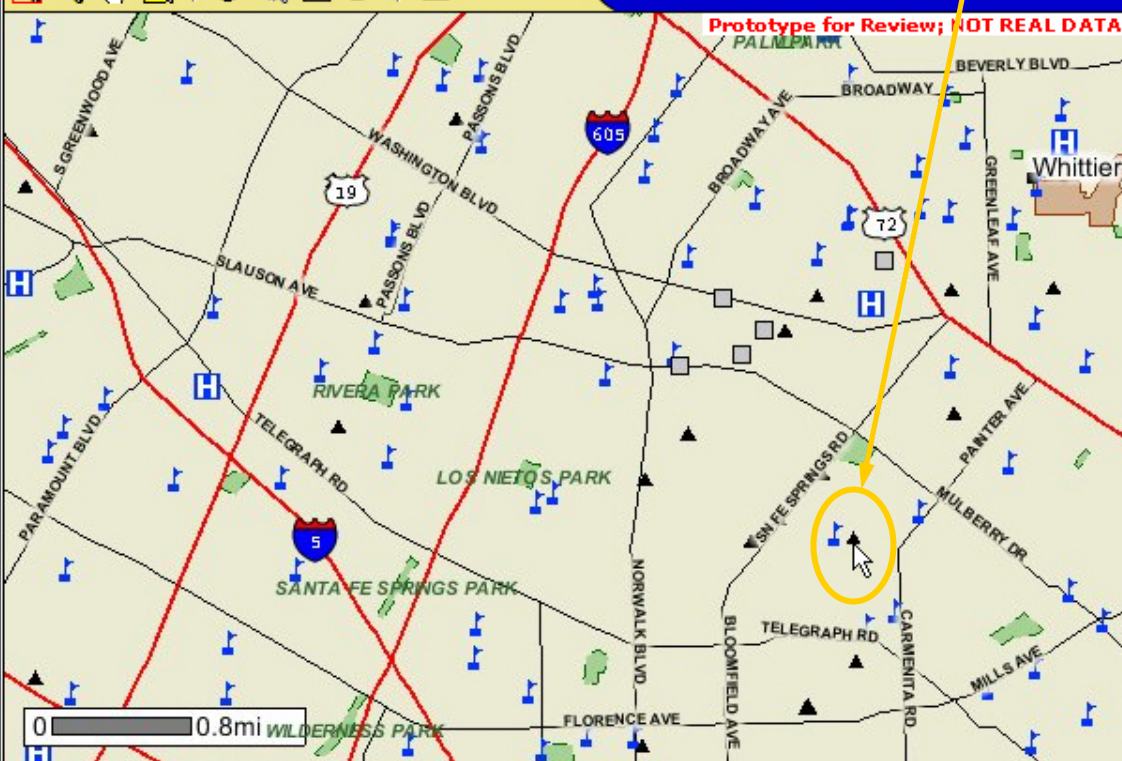


## Overview Map



ZYX COMPANY INC (18695)

Prototype for Review; NOT REAL DATA



Map Width: 6.3 miles

## Current Settings

Tool Mode: **Zoom In**

County: Los Angeles

## Messages

## Legend / Facilities

Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

[Show Full Legend](#)[Show Layer List](#)

## Combined Sources

Mobile, Areawide, and Stationary Totals.

[Gridded Emissions](#)[Gridded Risk](#)

## Analysis of Sources in Map View

Calculate Stats for all Point Sources in the Map View

[Calculate Stats](#)[Print Map](#)[Get Help](#)[Start Page](#)

Select pollutant: Benzene

[Clear](#)

Select facility type: —Facility Types &amp; SIC Codes—

[Go](#)

## Map Settings

Identify Layer:

Emissions

Map Tip Layer:

Emissions

2 miles

## Jump to a new location

County/Air Basin/Air District: Los Angeles

Regions: —REGIONS—

Zip Code:

[Go To Zip](#)

Not Real Data

# Calculate Summary for Facilities in the Entire Map View

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

**Navigation** **Analysis** **Overview Map**

**Prototype for Review; NOT REAL DATA**

**Current Settings**  
Tool Mode: **Zoom In**  
County: Los Angeles

**Messages**

**Legend / Facilities**  
Benzene (Lbs./yr.)  
▲ 0 - 1000  
▲ 1000 - 25000  
▲ 25000 - 116920

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.  
**Gridset Emissions** **Gridset Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View  
**Calculate Stats**

**Map Width: 6.3 miles**

Select pollutant: Benzene **Clear** Select facility type: —Facility Types & SIC Codes— **Go**

**Map Settings**  
Identify Layer: Emissions Map Tip Layer: Emissions 2 miles

**Jump to a new location**  
County/Air Basin/Air District: Los Angeles Regions: —REGIONS— Zip Code: **Go To Zip**

**Not Real Data**



# Summary List and Total for Facilities in the Map View

CHAPIS: Calculate Statistics Results - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back

Forward

Stop

Refresh

Home

Search

Favorites

History

## 22 Benzene industrial (point) emissions sources found

Maximum Value: 3700 Lbs./yr.

Average Value: 252 Lbs./yr.

Total Emissions: 5550 Lbs./yr.

**Note:** Data and summary statistics in this table are for point (industrial) sources only.

Use the "Gridded Emissions" option to see additional types of sources.

| Facil ID | Company                         | Address                                    | Benzene (Lbs./yr) | SIC Code                            |
|----------|---------------------------------|--|-------------------|-------------------------------------|
| 3240788  | <a href="#">ABC COMPANY INC</a> | 200000 A ST<br>SANTA FE SPRINGS, CA 90670  | 3700              | 13 - Oil and Gas Extraction         |
| 8748     | <a href="#">XYZ COMPANY INC</a> | 300000 B ST<br>PICO RIVERA, CA 90660       | 788               | 37 - Transportation Equipment       |
| 2289688  | <a href="#">EFG COMPANY INC</a> | 4000000 Q ST<br>PICO RIVERA, CA 90660      | 746               | 37 - Transportation Equipment       |
| 46500    | <a href="#">IJK COMPANY INC</a> | 2000000 J ST<br>SANTA FE SPRINGS, CA 90670 | 160               | 13 - Oil and Gas Extraction         |
| 24488    | <a href="#">GGG COMPANY INC</a> | 600000 G ST<br>SANTA FE SPRINGS, CA 93003  | 64.9              | 13 - Oil and Gas Extraction         |
| 23419    | <a href="#">POR COMPANY INC</a> | 1000000 F ST<br>PICO RIVERA, CA 90660      | 32                | 49 - Electric,Gas,Sanitary Services |
| 23351    | <a href="#">CCC COMPANY INC</a> | 400000 C ST<br>LOS ANGELES, CA 90040       | 2                 | 28 - Chemical and Allied Products   |
| 19251    | <a href="#">LMN COMPANY INC</a> | 5000000 T ST<br>WHITTIER, CA 90601         | 23.5              | 34 - Fabricated Metal Products      |
| 18695    | <a href="#">ZYX COMPANY INC</a> | 3000000 Z ST                               | 6.57              | 32 - Stone,Clay, and Glass Products |

Not real data.

http://www.arb.ca.gov/app/emsinv/facinfo/facdet.php?co\_=19&ab\_=SC&facid\_=3240788&dis\_=SC&dbyr=1996

Internet

## Jump to a new location

County/Air Basin/Air District: Los Angeles

Regions: REGIONS

Zip Code:

Go To Zip

## Link to Existing Database Query Tools for Facility Data

Facility Detail

File Edit View Favorites Tools Help

Back

Forward

Stop

Refresh

Home

Search

Favorites

History

## Facility Information

|                  |                       |            |                  |
|------------------|-----------------------|------------|------------------|
| Facility Name :  | ABC COMPANY INC.      | District : | SOUTH COAST AQMD |
| Street :         | 10735 S SHOEMAKER AVE |            |                  |
| City :           | SANTA FE SPRINGS      | Zip :      | 90670            |
| Contact Person : | ENVIRONMENTAL ENG     | Phone :    | (310) 903-2725   |
| Facility SIC :   | 1311                  |            |                  |

## Mailing address

|                |                              |       |       |
|----------------|------------------------------|-------|-------|
| Company Name : | ABC COMPANY INC.             |       |       |
| Address :      | 10735 SOUTH SHOEMAKER AVENUE |       |       |
| City :         | SANTA FE SPRINGS             | St :  | CA    |
|                |                              | Zip : | 90670 |

For most recent data, please contact the Air District

[\[Start a new query\]](#) [\[Prioritization & Risk\]](#)

|  | Pollutant   | Emissions | Unit    |
|--|-------------|-----------|---------|
| Data from 1996                         | TOG         | 21.8      | Tons/Yr |
|  | ROG         | 13.9      | Tons/Yr |
| TOXIC DATA MAY COME FROM VARIOUS YEARS |             |           |         |
|  | Ammonia     | 587.4     | Lbs/Yr  |
|  | Benzene     | 3702.4    | Lbs/Yr  |
|  | Naphthalene | 2398.4    | Lbs/Yr  |

Not real data.



# Link to Reported Risk Assessment if Available

## Facility Risk Information

Facility Name : ABC COMPANY INC.

District : [SOUTH COAST AQMD](#)

Street : 10735 S SHOEMAKER AVE

City : SANTA FE SPRINGS

Zip : 90670

*For most recent data, please contact the Air District*

[\[Start a new query\]](#)

Not real data

## Facility Health Risk and Score Data

| <a href="#">Facility Prioritization Score</a> | Inventory<br>Year | Value  | <a href="#">District Prioritization Threshold</a> |                     |
|---|-------------------|--------|---|---------------------|
|   |                   |        | <a href="#">High</a>                              | <a href="#">Low</a> |
| <a href="#">Cancer</a>                        | 1991              | 182.53 | 10  | 1                   |
| <a href="#">Non-Cancer Chronic</a>            | 1991              | 6.92   | 10  | 1                   |
| <a href="#">Non-Cancer Acute</a>              | 1991              | 1.07   | 10  | 1                   |

| <a href="#">Health Risk Assessment</a>          | Inventory<br>Year | Value | <a href="#">District Notification Level</a> | <a href="#">District RRAP Level</a> |
|---|-------------------|-------|---|-------------------------------------|
|   |                   |       |   |                                     |
| <a href="#">Cancer Risk</a>                     | 1991              | .79   | >=10  | >100                                |
| <a href="#">Non-Cancer Chronic Hazard Index</a> | 1991              | .04   | >1; lead THI >.5                            | >5                                  |
| <a href="#">Non-Cancer Acute Hazard Index</a>   | 1991              | .01   | >1; lead THI >.5                            | >5                                  |

# Special Features of the Calculate Statistics Function

## A. If No Pollutant Selected, Calc Stat Gives Summary for All Chemicals

59 industrial (point) emissions sources found

| Pollutant                                     | Units    | Total    | Average    | Maximum | <a href="#">Cancer-Potency Weighted Pounds</a> |
|---|----------|----------|------------|---------|--|
| <a href="#">Ammonia</a>                       | Lbs./yr. | 18400    | 311        | 7910    | N/A  |
| <a href="#">Arsenic (Inorganic) Compounds</a> | Lbs./yr. | 0.00667  | 0.000113   | 0.00667 | 136  |
| <a href="#">Asbestos and Related Fibers</a>   | Lbs./yr. | 0        | 0          | 0       | 0  |
| <a href="#">Benzene</a> ←                     | Lbs./yr. | 76.8     | 1.3        | 30.6    | 13100  |
| <a href="#">Beryllium Compounds</a>           | Lbs./yr. | 0.000301 | 0.00000509 | 0.0003  | 4.29   |
| <a href="#">1,3-Butadiene</a>                 | Lbs./yr. | 0        | 0          | 0       | 0  |
| <a href="#">Cadmium Compounds</a>             | Lbs./yr. | 0.00232  | 0.0000393  | 0.00227 | 59.2   |
| <a href="#">Carbon Tetrachloride</a>          | Lbs./yr. | 0        | 0          | 0       | 0  |
| <a href="#">Carbonyl Sulfide</a>              | Lbs./yr. | 0.61     | 0.0103     | 0.61    | N/A  |
| <a href="#">Chloroform</a>                    | Lbs./yr. | 26.2     | 0.444      | 26.2    | 846  |
| <a href="#">Chromium+6 Compounds</a>          | Lbs./yr. | 1.43     | 0.0242     | 0.928   | 1240000  |
| <a href="#">1,2-Dibromoethane (EDB)</a>       | Lbs./yr. | 0        | 0          | 0       | 0  |
| <a href="#">p-Dichlorobenzene</a>             | Lbs./yr. | 0        | 0          | 0       | 0  |
| <a href="#">1,2-Dichloroethane</a>            | Lbs./yr. | 0        | 0          | 0       | N/A  |

NOTE: Displayed data are not real.



## BENZENE

Identified as a toxic air contaminant under California's air toxics program (AB 1807) in 1984.

CAS Registry Number: 71-43-2

Molecular Formula:  $C_6H_6$ 

Benzene is a clear, colorless, volatile, highly flammable liquid with a characteristic sickly, sweet odor. It is chemically characterized by six carbon atoms linked in a planar symmetrical hexagon (equal C-C bond lengths) with each carbon atom attached to a hydrogen atom. The electronic structure of that geometry makes benzene unusually stable. It does react with other compounds mainly by the substitution of a hydrogen atom (U.S. EPA, 1993b). Benzene is soluble in water and miscible with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone, and oils (Merck, 1989).

### Physical Properties of Benzene

Synonyms: benzol; benzole; bicarburet of hydrogen; pyrobenzol; cyclohexatriene; annulene; coal naphtha; phene; phenyl hydride

|  |  |
|--|--|
| Molecular Weight:                        | 78.11                                    |
| Boiling Point:                           | 80.1 °C                                  |
| Melting Point:                           | 5.5 °C                                   |
| Flash Point:                             | -11.1 °C (closed cup)                    |
| Vapor Pressure:                          | 100 mm Hg at 26.1 °C                     |
| Vapor Density:                           | 2.7 (air = 1)                            |
| Density/Specific Gravity:                | 0.8787 at 15/4 °C                        |
| Henry's Law Constant, water:             | 0.0055 atm·m <sup>3</sup> /mole at 25 °C |
| Log Octanol/Water Partition Coefficient: | 2.13                                     |
| Conversion Factor:                       | 1 ppm = 3.19 mg/m <sup>3</sup>           |

(Howard, 1990; HSDB, 1995; Merck, 1989; Sax, 1989; U.S. EPA, 1994a)

## SOURCES AND EMISSION

### A. Sources

The predominant sources of total benzene emissions in the atmosphere are gasoline fugitive emissions and gasoline motor vehicle exhaust. Mobile sources contribute 85 percent and

CHAPIS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail

CHAPIS: Calculate Statistics Results - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home

59 industrial (point) emissions sources found

| Pollutant                                     | Units    | Total    | Average    | Maximum | Cancer-Potency Weighted Pounds |
|---|----------|----------|------------|---------|--------------------------------|
| <a href="#">Ammonia</a>                       | Lbs./yr. | 18400    | 311        | 7910    | N/A                            |
| <a href="#">Arsenic (Inorganic) Compounds</a> | Lbs./yr. | 0.00667  | 0.000113   | 0.00667 | 136                            |
| <a href="#">Asbestos and Related Fibers</a>   | Lbs./yr. | 0        | 0          | 0       | 0                              |
| <a href="#">Benzene</a>                       | Lbs./yr. | 76.8     | 1.3        | 30.6    | 13100                          |
| <a href="#">Beryllium Compounds</a>           | Lbs./yr. | 0.000301 | 0.00000509 | 0.0003  | 4.29                           |
| <a href="#">1,3-Butadiene</a>                 | Lbs./yr. | 0        | 0          | 0       | 0                              |
| <a href="#">Cadmium Compounds</a>             | Lbs./yr. | 0.00232  | 0.0000393  | 0.00227 | 59.2                           |
| <a href="#">Carbon Tetrachloride</a>          | Lbs./yr. | 0        | 0          | 0       | 0                              |
| <a href="#">Carbonyl Sulfide</a>              | Lbs./yr. | 0.61     | 0.0103     | 0.61    | N/A                            |
| <a href="#">Chloroform</a>                    | Lbs./yr. | 26.2     | 0.444      | 26.2    | 846                            |
| <a href="#">Chromium+6 Compounds</a>          | Lbs./yr. | 1.43     | 0.0242     | 0.928   | 1240000                        |
| <a href="#">1,2-Dibromoethane (EDB)</a>       | Lbs./yr. | 0        | 0          | 0       | 0                              |
| <a href="#">p-Dichlorobenzene</a>             | Lbs./yr. | 0        | 0          | 0       | 0                              |
| <a href="#">1,2-Dichloroethane</a>            | Lbs./yr. | 0        | 0          | 0       | N/A                            |

Click on map to zoom in or out

Navigation

Map View

Select

Map Scale

0 miles

Jump to a new location

County/Air Basin/Air District: Los Angeles Regions: REGION

Full Legend

Layer List

ed Risk

Map View

Start Page

Go

miles

NOTE: Displayed data are not real.

Start CHAPIS - Microsoft Internet Explorer CHAPIS: Calculate Statistics Results 1:10 PM



# On-Line Help and Explanation of Terms

## Cancer Potency Weighted Pounds

Potn-Wtd Lbs = Emissions of Pollutant (in lbs) x Cancer Potency Weight Index for that Pollutant x 1700.

(The 1700 is a "normalization constant" derived using health- conservative modeling assumptions to create a "score" scale where a resultant "score" of "~10 or more" starts to be potentially important from a public health perspective).

## Criteria Air Pollutant

The staff at the California Air Resources Board compiles data to create the criteria pollutant emission inventory which includes information on the emissions of reactive organic gases (ROG), oxides of nitrogen (NOx), oxides of sulfur (SOx), carbon monoxide (CO), and particulate matter (PM10).

## Dispersed Sources of Emissions (Area-wide sources)

Area-wide sources include widely dispersed sources such as the use of consumer products (hairspray, home automotive products, home cleaners, etc.) and other dispersed solvent uses, such as painting (sometimes referred to as architectural coating). Area-wide emission sources are generally estimated at a county-level of resolution, then spatially aggregated to smaller areas using spatial allocation factors that are based on a surrogate, such as the distribution of population used to allocate consumer product usage.

## Emission Inventory

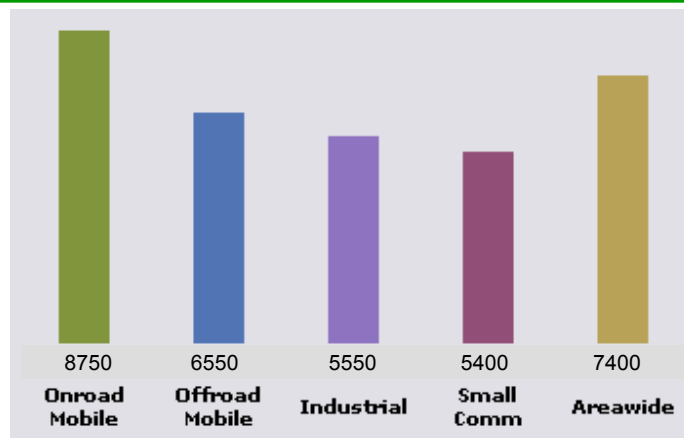
The California Air Resources Board has collected information on emissions from air pollution sources since 1969. This information is periodically compiled by State and local air pollution control agencies to create an emission inventory; an important building block in the development of the State's air pollution control program.

The emission inventory includes information on the emissions of criteria and toxic air pollutants. Criteria pollutants include reactive organic gases (ROG), oxides of nitrogen (NOx), oxides of sulfur (SOx), carbon monoxide (CO), and particulate matter (PM10). Toxic data available within CHAPIS were collected in response to [Assembly Bill \(AB\) 2588 \(Connelly\), the Air Toxics "Hot Spots" Information and Assessment Act](#). Criteria and toxic data are gathered on an ongoing basis and stored in the California Emission Inventory Development and Reporting System (CEIDARS).

## Mobile Sources of Emissions

## B. Developing Calculate Stat Feature for Combined Sources

### Combined Sources Within Map View:



### 22 Benzene industrial (point) emissions sources found

Maximum Value: 3700 Lbs./yr.    **Note:** Data and summary statistics in this table are for point (industrial) sources only.  
Average Value: 252 Lbs./yr.  
Total Emissions: 5550 Lbs./yr.

| Facil ID | Company                         | Address                                    | Benzene (Lbs./yr) | SIC Code                      |
|----------|---------------------------------|--|-------------------|-------------------------------|
| 3240788  | <a href="#">ABC COMPANY INC</a> | 200000 A ST<br>SANTA FE SPRINGS, CA 90670  | 3700              | 13 - Oil and Gas Extraction   |
| 8748     | <a href="#">XYZ COMPANY INC</a> | 300000 B ST<br>PICO RIVERA, CA 90660       | 788               | 37 - Transportation Equipment |
| 2289688  | <a href="#">EFG COMPANY INC</a> | 4000000 Q ST<br>PICO RIVERA, CA 90660      | 746               | 37 - Transportation Equipment |
| 46500    | <a href="#">IJK COMPANY INC</a> | 2000000 J ST<br>SANTA FE SPRINGS, CA 90670 | Not real data.    | s Extraction                  |
| 24488    | <a href="#">GGG COMPANY INC</a> | 600000 G ST<br>SANTA FE SPRINGS, CA 93003  |                   | 13 - Oil and Gas Extraction   |



# Measure Distances with Circles (or Lines)

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click on the map to create a **circular buffer**

**Navigation** **Analysis** **Overview Map**

1) Click to select this map-tool 2) Select a CIRCLE size 3) Click on map to draw a CIRCLE

**Current Settings**  
Tool Mode: **Buffer**  
County: Los Angeles

**Messages**  
22 Benzene industrial (point) emissions sources found

**Legend / Facilities**  
Benzene (Lbs./yr.)  
▲ 0 - 1000  
▲ 1000 - 25000  
▲ 25000 - 116920

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.  
**Gridded Emissions** **Gridded Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View  
**Calculate Stats**

**Map Width: 6.3 miles**

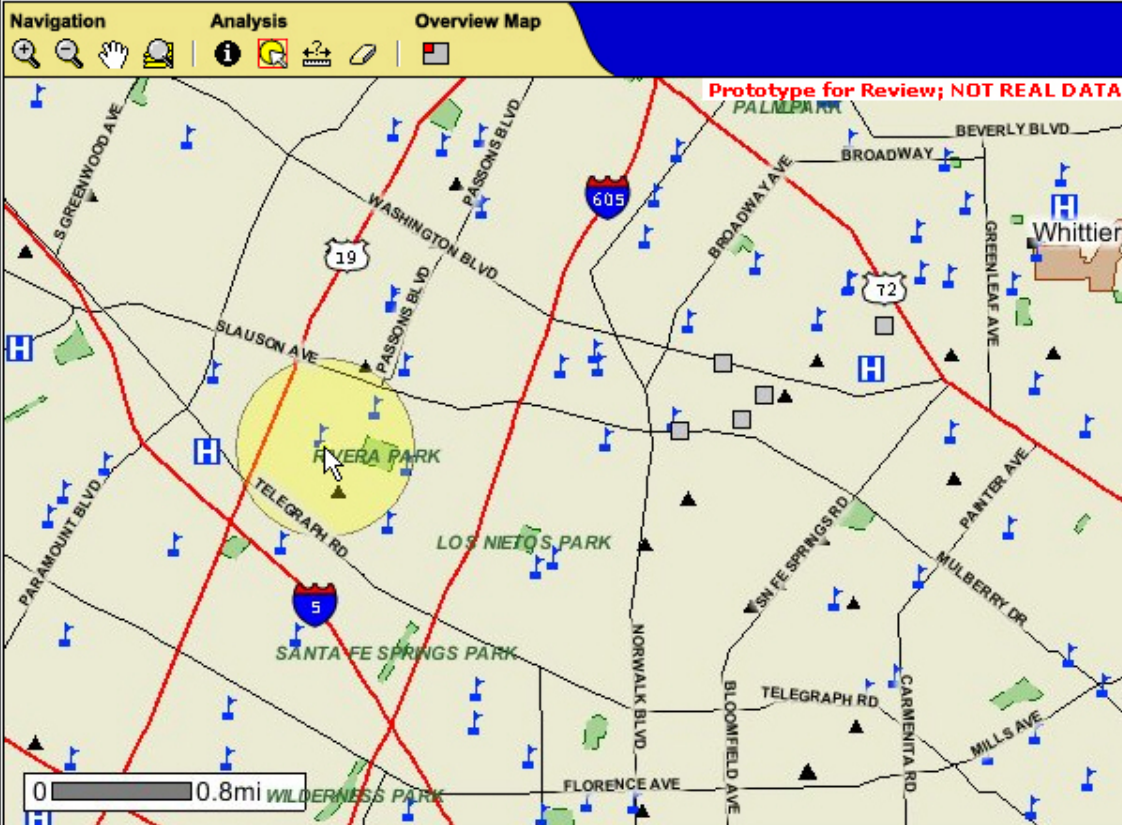
Select pollutant: Benzene **Clear** Select facility type: —Facility Types & SIC Codes— **Go**

**Map Settings**  
Identify Layer: Emissions Map Tip Layer: Emissions Buffer Radius: 1/2 mile

**Jump to a new location**  
County/Air Basin/Air District: Los Angeles Regions: —REGIONS— Zip Code: **Go To Zip**

NOTE: Displayed data are not real.

Click on the map to create a circular buffer



## Current Settings

Tool Mode: Buffer

County: Los Angeles

## Messages

## Legend / Facilities

Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

Show Full Legend

Show Layer List

## Combined Sources

Mobile, Areawide, and Stationary Totals.

Gridded Emissions

Gridded Risk

## Analysis of Sources in Map View

Calculate Stats for all Point Sources in the Map View

Calculate Stats

Print Map

Get Help

Start Page

Select pollutant: Benzene

Clear

Select facility type: Facility Types &amp; SIC Codes

Go

## Map Settings

Identify Layer:

Emissions

Map Tip Layer:

Emissions



Buffer Radius:

1/2 mile

## Jump to a new location

County/Air Basin/Air District:

Los Angeles

Regions:

REGIONS

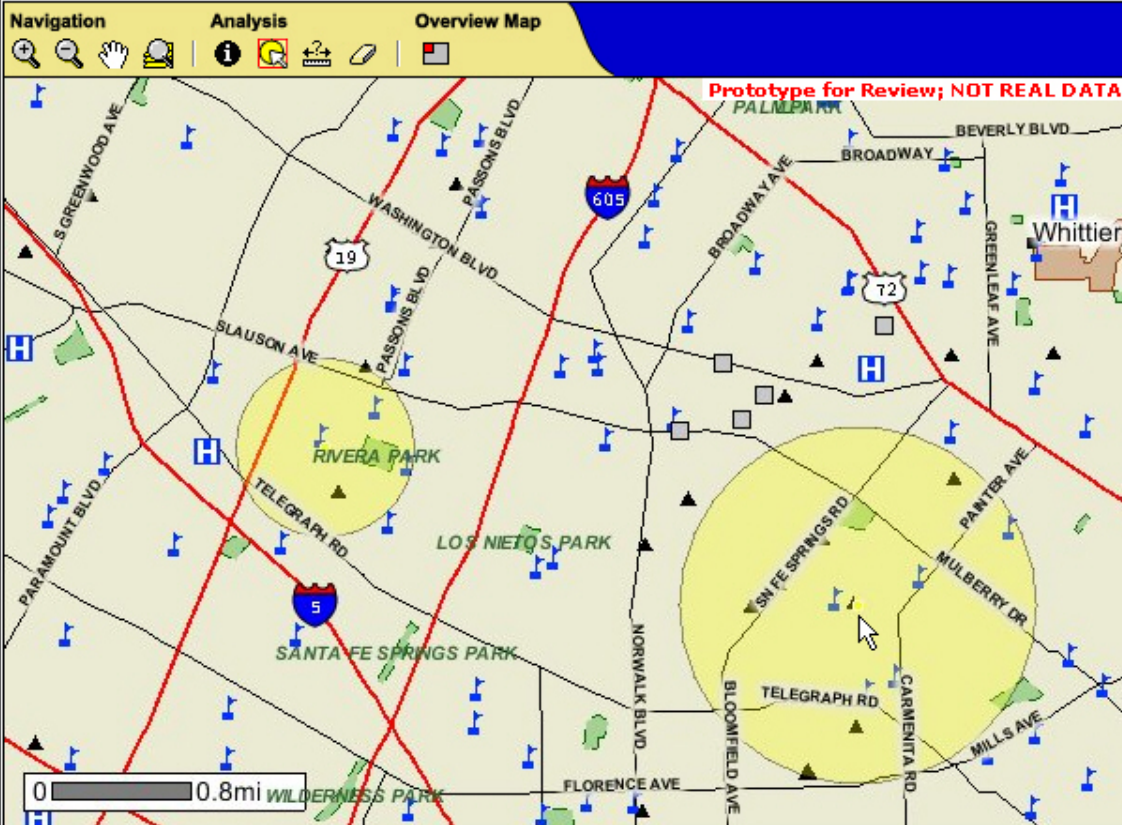
Zip Code:

Go To Zip

NOTE: Displayed data are not real.



Click on the map to create a circular buffer



## Current Settings

Tool Mode: Buffer

County: Los Angeles

## Messages

## Legend / Facilities

Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

Show Full Legend

Show Layer List

## Combined Sources

Mobile, Areawide, and Stationary Totals.

Gridded Emissions

Gridded Risk

## Analysis of Sources in Map View

Calculate Stats for all Point Sources in the Map View

Calculate Stats

Print Map

Get Help

Start Page

Select pollutant: Benzene

Clear

Select facility type: Facility Types &amp; SIC Codes

Go

## Map Settings

Identify Layer:

Emissions

Map Tip Layer:

Emissions

Buffer Radius:

1 mile

## Jump to a new location

County/Air Basin/Air District: Los Angeles

Regions:

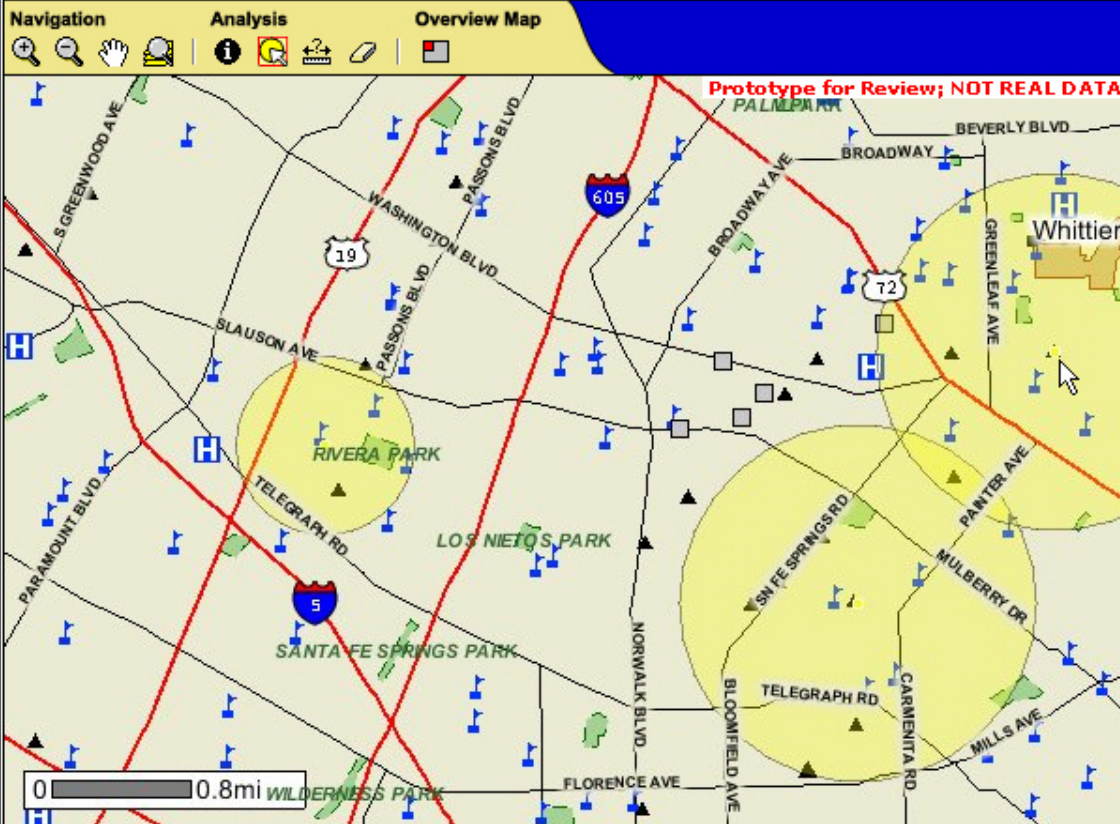
REGIONS

Zip Code:

Go To Zip

NOTE: Displayed data are not real.

Click on the map to create a circular buffer



## Current Settings

Tool Mode: Buffer

County: Los Angeles

## Messages

## Legend / Facilities

Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

Show Full Legend

Show Layer List

## Combined Sources

Mobile, Areawide, and Stationary Totals.

Gridded Emissions

Gridded Risk

## Analysis of Sources in Map View

Calculate Stats for all Point Sources in the Map View

Calculate Stats

Print Map

Get Help

Start Page

Select pollutant: Benzene

Clear

Select facility type: Facility Types &amp; SIC Codes

Go

## Map Settings

Identify Layer:

Emissions

Map Tip Layer:

Emissions

Buffer Radius:

1 mile

## Jump to a new location

County/Air Basin/Air District: Los Angeles

Regions:

REGIONS

Zip Code:

Go To Zip

NOTE: Displayed data are not real.



California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

**Navigation** **Analysis** **Overview Map**

**Map**

**Current Settings**  
Tool Mode: **Zoom In**  
County: Los Angeles

**Messages**

**Legend / Facilities** **Show Full Legend** **Show Layer List**

Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.

**Gridded Emissions** **Gridded Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View

**Calculate Stats**

**Print Map** **Get Help** **Start Page**

Map Width: 6.3 miles

Select pollutant: Benzene **Clear** Select facility type: —Facility Types & SIC Codes— **Go**

**Map Settings**

**Identify Layer:** Emissions **Map Tip Layer:** Emissions **Buffer Radius:** 1 mile

**Jump to a new location**

County/Air Basin/Air District: Los Angeles **Regions:** —REGIONS— **Zip Code:** **Go To Zip**

Click for a printer-friendly version of this page

NOTE: Displayed data are not real.



California

Air Resources Board

CHAPIS

Community Health Air Pollution Information System

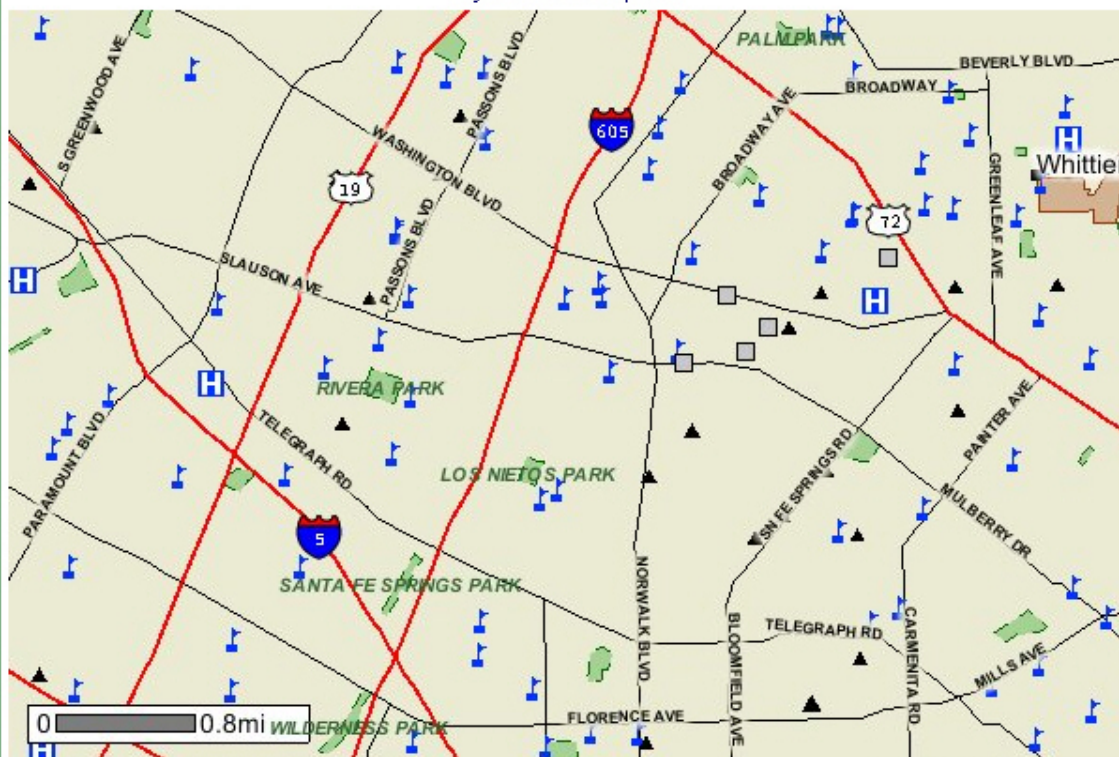


Benzene (Lbs./yr.)

- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920

- Chrome Platers
- Cities
- H Hospitals
- 🚶 Schools
- Air Monitoring Devices
- 🛣 Highways
- 🛤 Roads
- 🌊 Major Water Bodies
- ✈ Airports (Boundary)
- 🌳 Parks
- Landmarks
- 🏫 Colleges and Universities
- 🏭 Military Facilities
- 🏟 Sports Facilities
- 🎡 Theme Parks
- 🗺 Counties

My CHAPIS Map Title



County: Los Angeles

Selected Pollutant: Benzene



Data Source: ARB/PTSD

Print Date: 4/15/2003 10:19

NOTE: Displayed data are not real.



# Can Specify an Industry Category; Grey Out the Rest

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click or drag a box on the map to **Zoom In**

**Navigation** **Analysis** **Overview Map**

**Map**

Prototype for Review; NOT REAL DATA

**Current Settings**  
Tool Mode: **Zoom In**  
County: Los Angeles

**Messages**

**Legend / Facilities**

- Benzene (Lbs./yr.)
- ▲ 0 - 1000
- ▲ 1000 - 25000
- ▲ 25000 - 116920
- ▲ Non-SIC Sources

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.

**Gridded Emissions** **Gridded Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View

**Calculate Stats**

**Print Map** **Get Help** **Start Page**

Map Width: 6.3 miles

Select pollutant: Benzene **Clear** Select facility type: 13 - Oil and Gas Extraction **Clear**

**Map Settings**

Identify Layer: Emissions Map Tip Layer: Emissions **Not real data** 1 mile

**Jump to a new location**

County/Air Basin/Air District: Los Angeles Regions: — REGIONS — Zip Code: **Go To Zip**

# "Address-only" Facilities – Info Box with Link

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click on the map to **Identify** a feature

Navigation Analysis Overview Map

Current Settings  
Tool Mode: **Identify**  
County: Los Angeles

CHAPIS: Identify Results - Microsoft Internet Explorer

1 feature found

| Facility Name      | Comments  |
|--------------------|---|
| ABCD Metal Plating | Site-specific emissions not available for Chrome Platers. For information on Chrome Plating risks and actions being taken, <a href="#">click here</a> |

Map Width: 6.3 miles

Select pollutant: Benzene Clear Select facility type: —Facility Types & SIC Codes— Go

Map Settings

Identify Layer: Chrome Platers Map Tip Layer: Emissions 1 mile

Jump to a new location

County/Air Basin/Air District: Los Angeles Regions: —REGIONS— Zip Code: Go To Zip

Gridded Emissions Gridded Risk

Analysis of Sources in Map View  
Calculate Stats for all Point Sources in the Map View


Calculate Stats

Print Map Get Help Start Page

Not real data

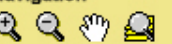



## Identify on an Air Monitor Data


 **California** Air Resources Board

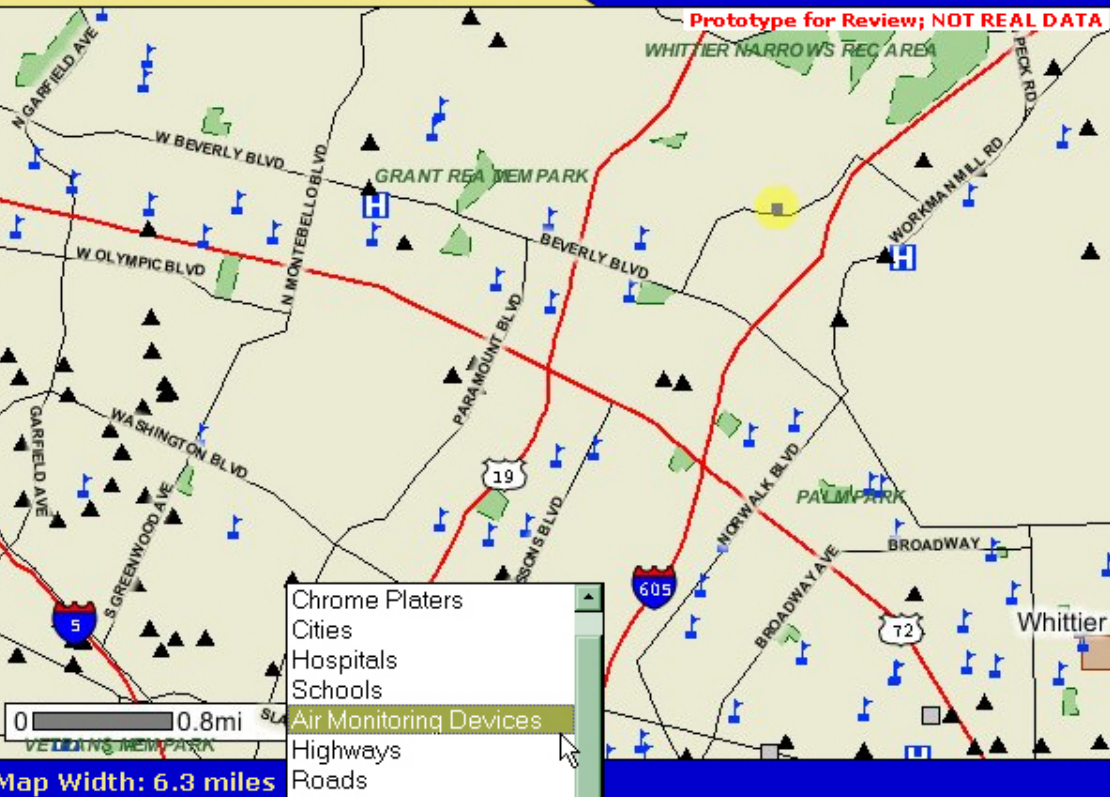
**CHAPIS** Community Health Air Pollution Information System

Click on the map to **Identify** a feature

**Navigation**  


**Analysis**  


**Overview Map**  




**Prototype for Review; NOT REAL DATA**

Map Width: 6.3 miles

Select pollutant:

**Map Settings**

Identify Layer:

Map Tip Layer:

Buffer Radius:

Go  Go

**Jump to a new location**

County/Air Basin/Air District:  Regions:  Zip Code:  **Go To Zip**

**Current Settings**  
Tool Mode: **Identify**  
County: Los Angeles

**Messages**  
1 feature found

**Legend / Facilities**  
▲ Facilities  
**Show Full Legend**  
**Show Layer List**

**Combined Sources**  
Mobile, Areawide, and Stationary Totals.  
**Gridded Emissions** **Gridded Risk**

**Analysis of Sources in Map View**  
Calculate Stats for all Point Sources in the Map View  
**Calculate Stats**  
**Print Map** **Get Help** **Start Page**

# Prototype Link to Air Monitor Data

CHAPIS - Microsoft Internet Explorer

File Edit View Favorites Tools

California Air Resources Board CHAPIS Community Health Air Pollution Information System

Click on the map to **Identify** a feature

Navigation Analysis Overview Map

Prototype for Review; NOT REAL DATA

Current Settings  
Tool Mode: Identify  
County: Los Angeles

Messages  
1 feature found

California Home ARB: Home Search Site Map Links Software Contact Us AGD: Home

Welcome to California Air Resources Board

View a Different Substance  
Order a Data CD

Annual Statewide Toxics Summary **Benzene**  
parts per billion

| Year | Months Present | Minimum | Median | Mean | 90th Percentile | Maximum | Standard Deviation |
|------|----------------|---------|--------|------|-----------------|---------|--------------------|
| 2001 | *****          | 0.1     | 0.5    | 0.61 | 1.2             | 4.2     | 0.54               |
| 2000 | *****          | 0.1     | 0.5    | 0.71 | 1.6             | 4.9     | 0.64               |
| 1999 | *****          | 0.1     | 0.6    | 0.85 | 1.7             | 9.9     | 0.80               |
| 1998 | *****          | 0.1     | 0.6    | 0.86 | 1.7             | 4.6     | 0.71               |
| 1997 | *****          | 0.1     | 0.6    | 0.85 | 1.8             | 6.9     | 0.84               |
| 1996 | *****          | 0.25    | 0.25   | 0.93 | 1.9             | 7.4     | 0.95               |
| 1995 | *****          | 0.25    | 1.2    | 1.31 | 2.7             | 11      | 1.08               |
| 1994 | *****          | 0.25    | 1.4    | 1.58 | 2.9             | 7.8     | 1.12               |
| 1993 | *****          | 0.25    | 1.3    | 1.50 | 3.0             | 5.5     | 1.10               |
| 1992 | *****          | 0.25    | 1.5    | 1.71 | 3.4             | 6.5     | 1.19               |
| 1991 | *****          | 0.25    | 1.7    | 2.14 | 4.3             | 8.4     | 1.52               |
| 1990 | *****          | 0.25    | 2.2    | 2.57 | 4.5             | 10      | 1.66               |
| 1989 | *****          | 0.25    | 2.3    | 2.97 | 5.4             | 16      | 2.21               |

Graph It!

Statewide Summary Graph for Benzene - Microsoft Internet Explorer

California Air Resources Board Benzene

ppb

Year

90th Percentile  
Mean  
Detection Limit

Map Width: 0

Select pollutant

Map Settings

Identify Layer: Air Monitoring Devices Map Tip Layer: Emissions Buffer Radius: 2 miles

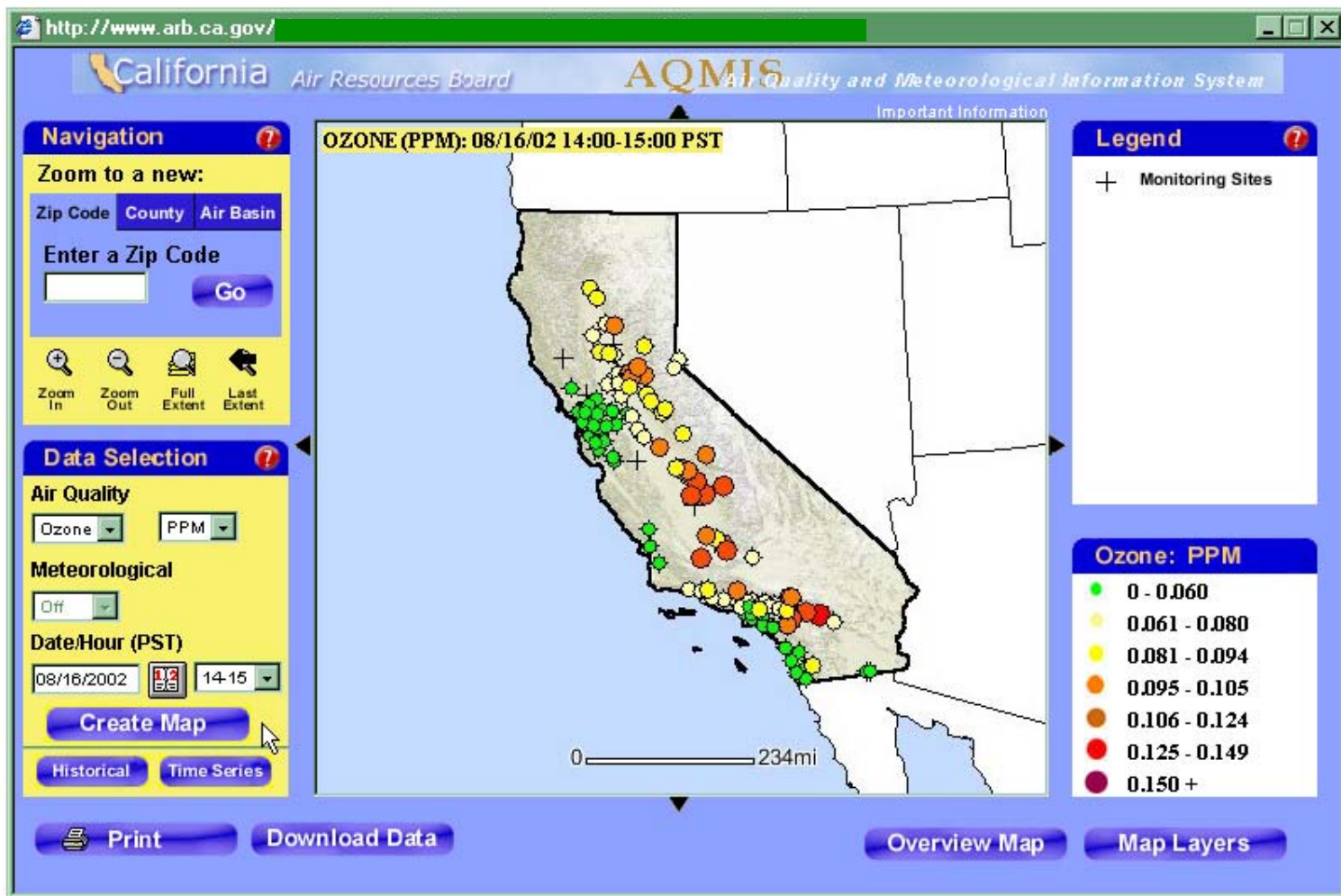
Jump to a new location

County/Air Basin/Air District: Los Angeles Regions: REGIONS Zip Code: Go To Zip

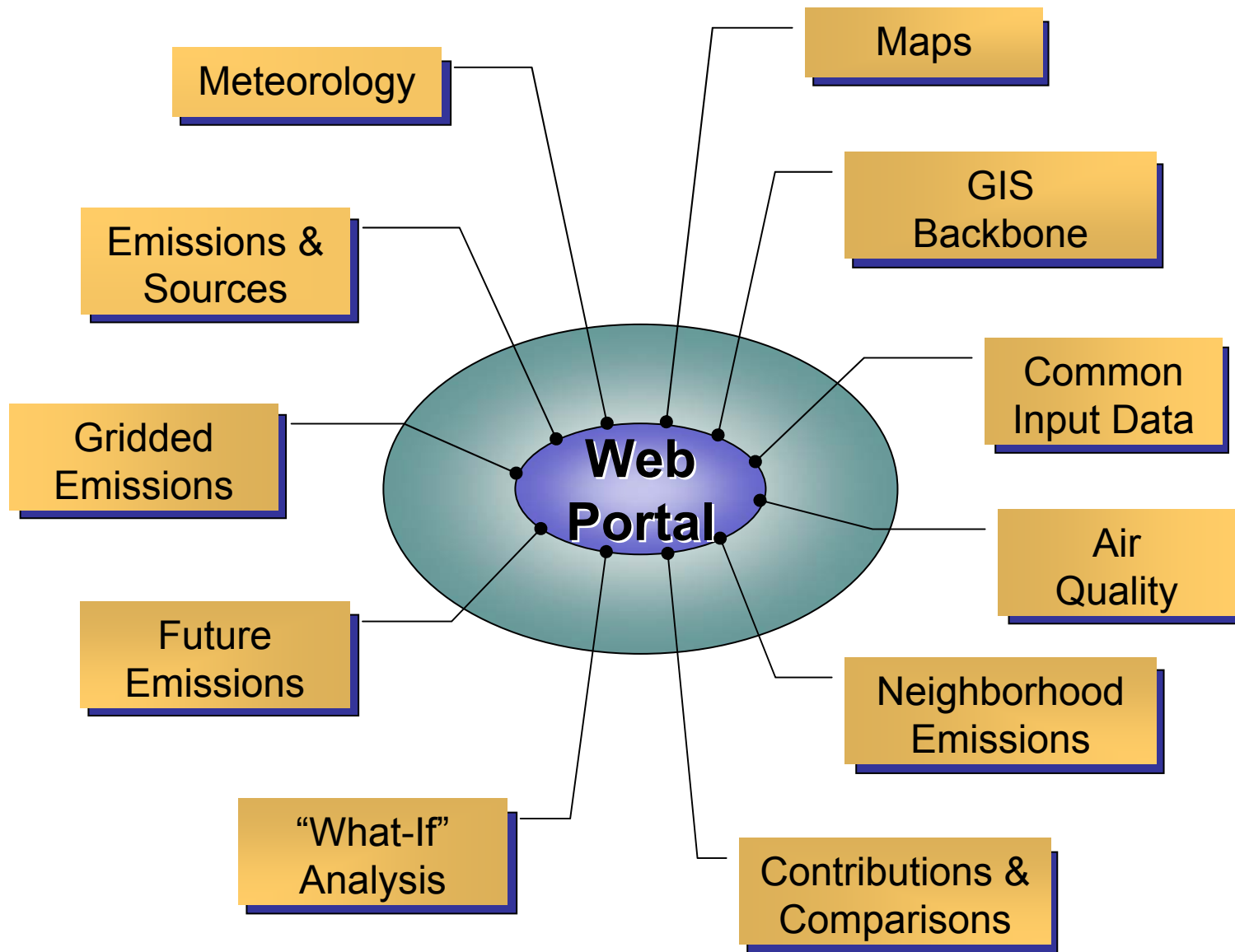
To Write an E-mail with Comments or Questions On CHAPIS:



# Future Link to AQMIS: Real-Time Air Monitoring Data Map



# Vision - Air Analysis Site Capabilities

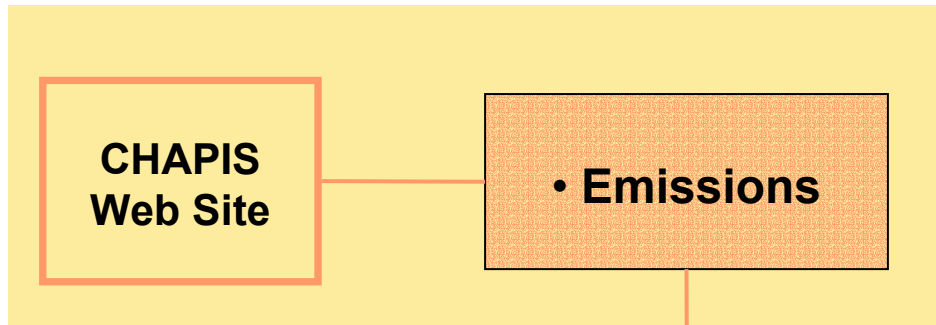




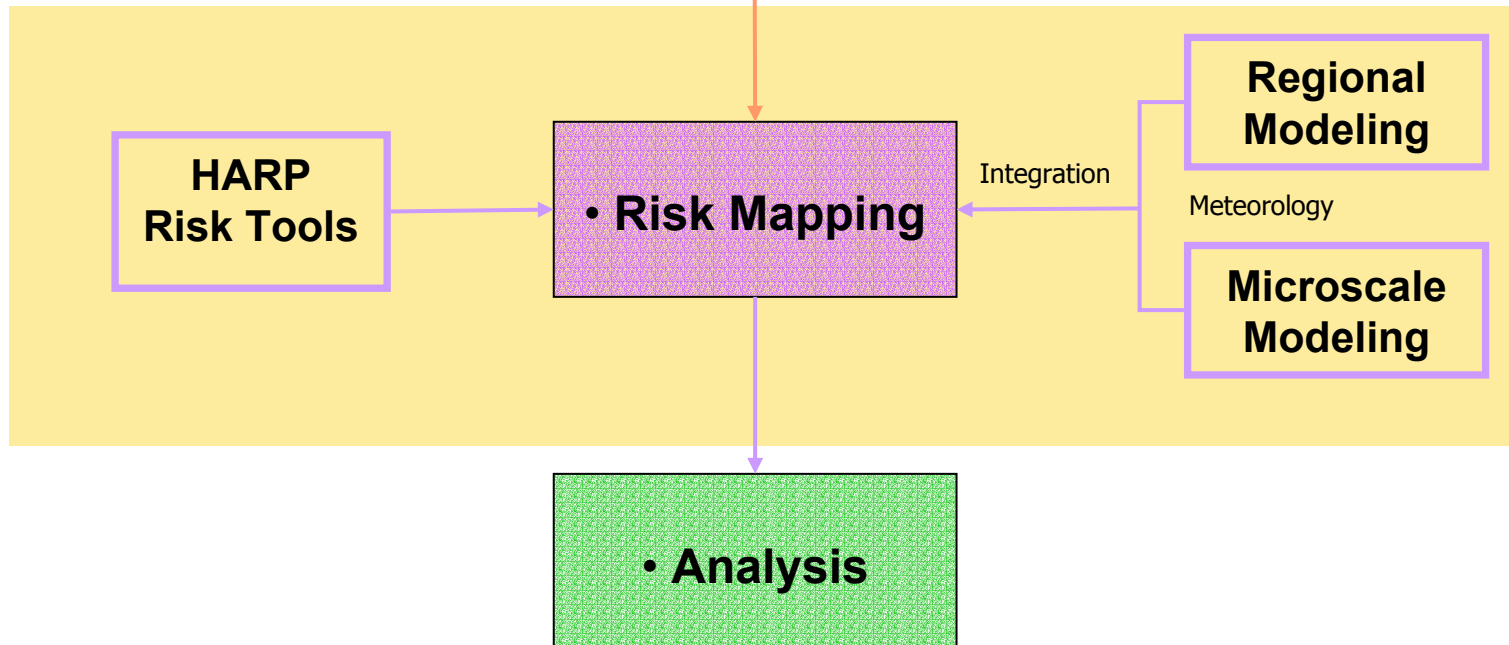
# Air Pollution Impact Assessment

## - Long-Term Tools and Applications -

Phase 1



Phase 2



\* **CHAPIS:** Community Health Air Pollution Information System (web-mapping tool)

\* **HARP:** HotSpots Analysis and Reporting Program (emissions + dispersion + risk modules)



# Summary: CHAPIS Visualization Tool

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- **CHAPIS Phase 1 helps users visualize and analyze emission data spatially**
- **Long-term goal: combine emissions, air monitors, modeling, toxic risk, and other data**
- **Data quality is key**
- **Communicate data -- promote involvement and improve decision-making**



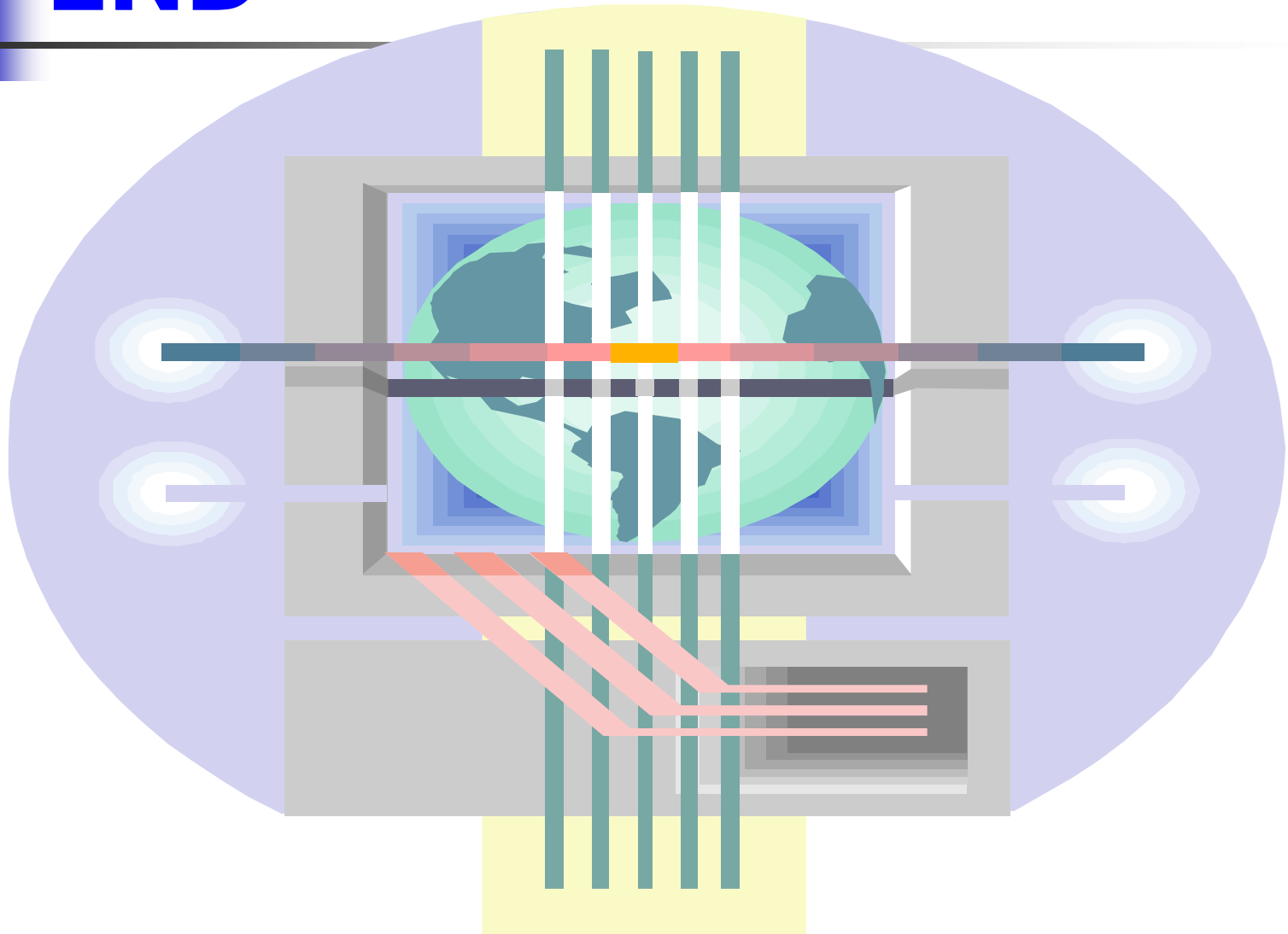


# Acknowledgements

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- ◆ VESTRA Resources, Inc. – CHAPIS programming
  - David Marley, Mark Smith, Perry Rice
- ◆ Dillingham Software Engineering – HARP program
  - Jeff Dillingham
- ◆ Web page support
  - Desktop Advantage; Chris Halm, ARB

**END**

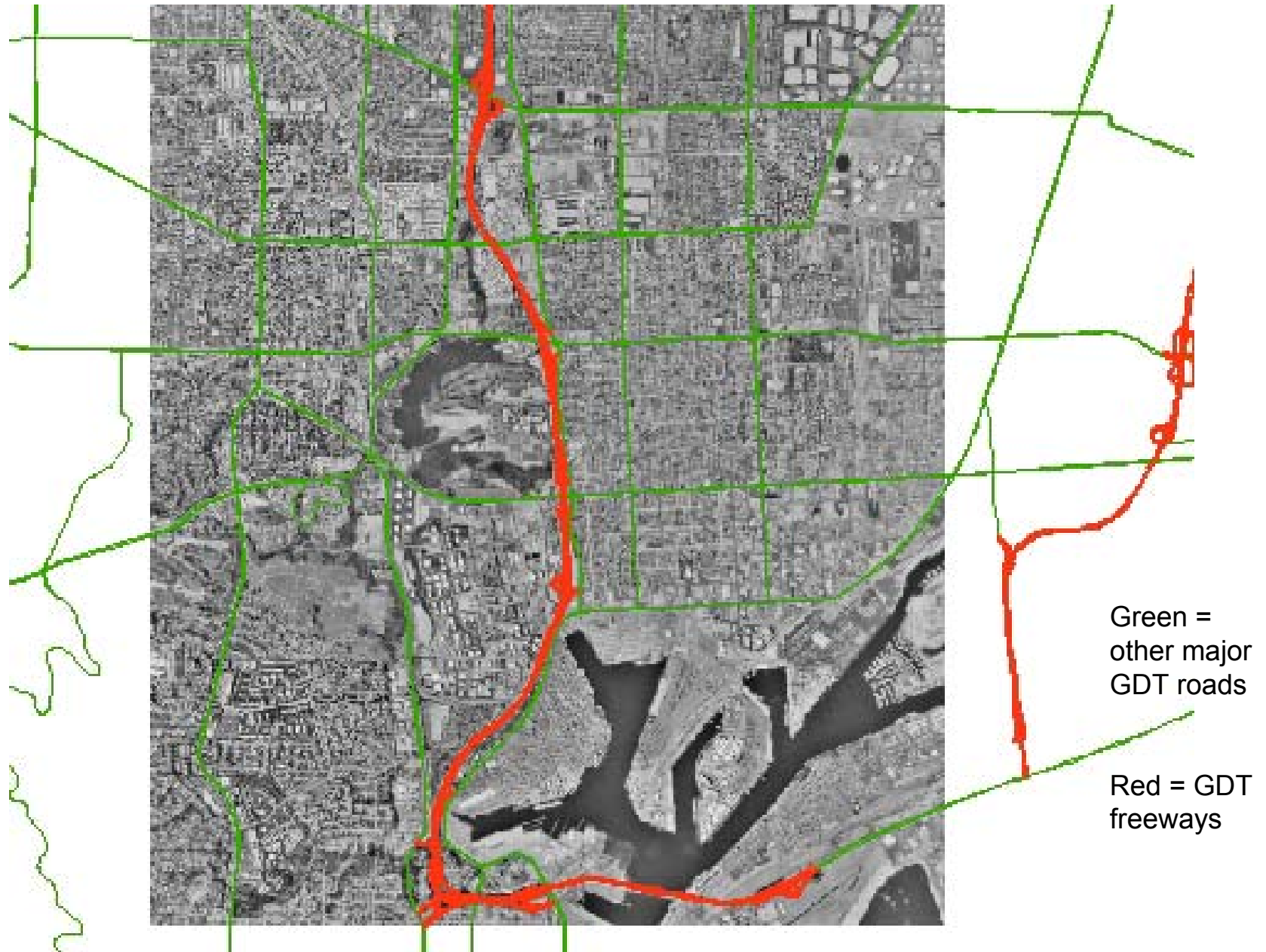




# Ground-Truthing the Available Road Networks, Using Aerial Imagery

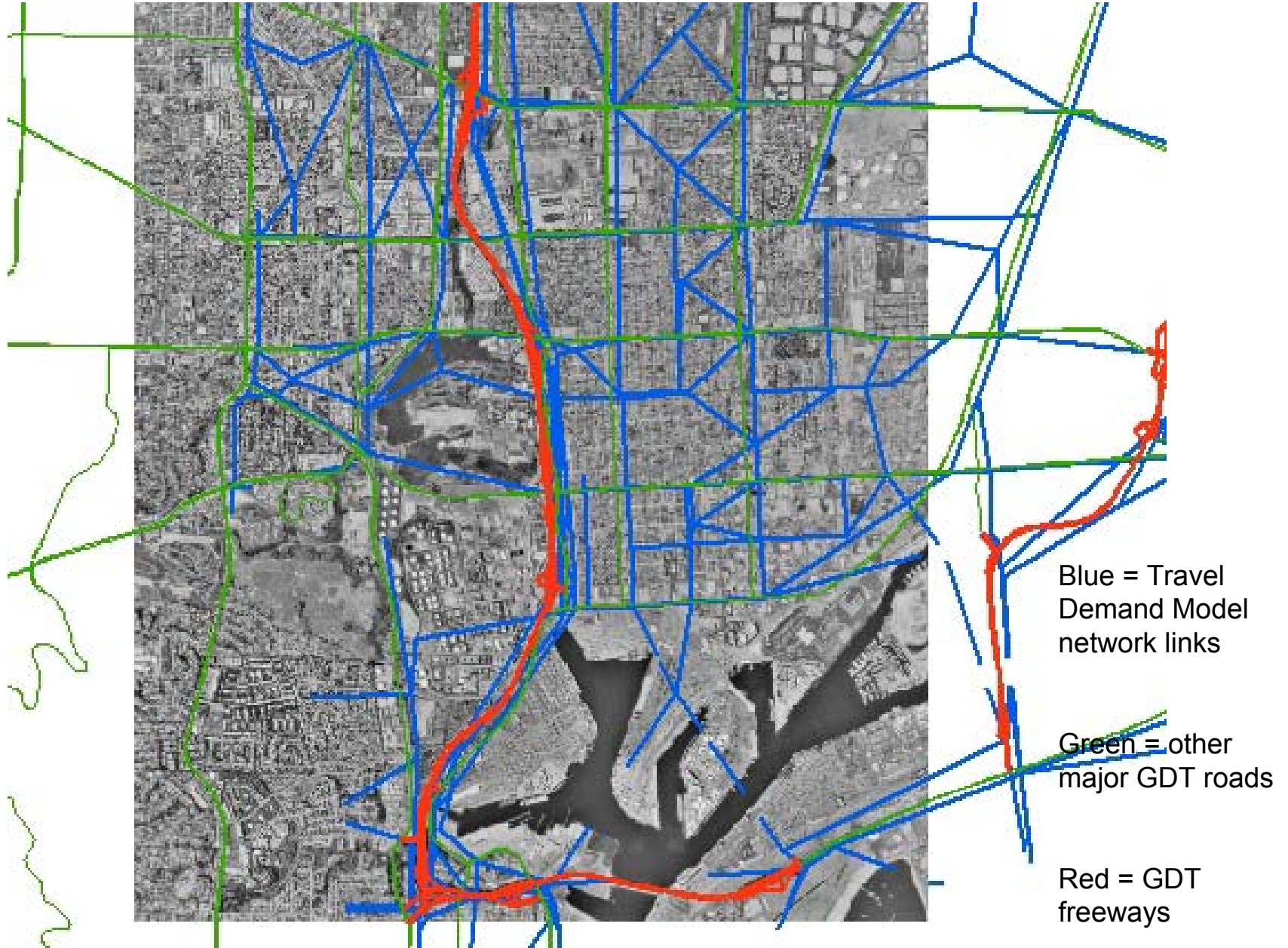


# Ground-Truthing the Available Road Networks, Using Aerial Imagery





# Ground-Truthing the Available Road Networks, Using Aerial Imagery





# CHAPIS Design Considerations

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- ♦ **Support public – diverse browsers, speeds**
  - “Thin client” (no plug-ins or frames)
  - Adjusts for user’s browser version, display resolution
- ♦ **GIS tools for the Internet**
  - Custom code on server; to allow simple client